

Design and Development of VHF Antennas for SoOp(Signal of Opportunity) Receiver for 6U Cubesat Platforms

Completed Technology Project (2014 - 2016)



Project Introduction

The main goal of the project is to design, fabricate, and test deployable VHF antennas for 6U Cubesat platforms to enable validation of root zone soil moisture (RZSM) estimation algorithms for signal of opportunity (SoOp) remote sensing. The proposed work has a strong link for establishing a technology development path for maturing truly global direct surface soil moisture (SM) and RZSM measurement system (as shown in Figure 1) over variety of land covers with limited density restrictions. In SoOp methodology, signals transmitted by already existing transmitters (known as transmitters of opportunity, in this case Military Satellite Communication (MilSatCom) System(known as Follow-on)) are utilized to measure properties of reflecting targets by recording reflected signals using a simple passive microwave receiver.

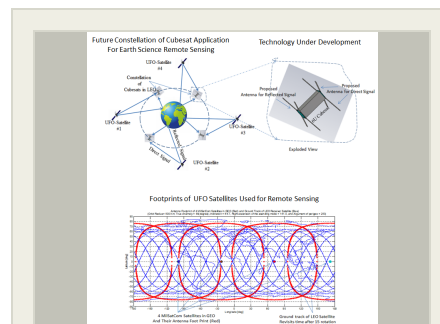
The project plans: (1) to develop and test a deployable VHF antenna technology for SoOp receiver for 6U Cubesat platforms; (2) to perform measurement of SM and RZSM using the proposed antennas; and finally (3) to validate the RZSM and SM estimation algorithms from the measured data. The proposed technology is to help the maturation of constellation of space borne Cubesats mission concept (as shown in Figure 1) for remote sensing of soil moisture (SM) and RZSM using MilSatCom System as transmitters of opportunity

Anticipated Benefits

Current observations of surface SM from space by L-band radiometers and radar are limited to indirect measurements of surface SM through moderate amounts of vegetation. This limitation is mainly due to the inability of L-band signals to penetrate through the vegetable canopy and top ground surface layer. To overcome the above limitation, low-frequency active radars operating have been investigated. However, these airborne observations are handicapped because of difficulties in getting permission from the FCC (Federal Communication Commission) and the NTIA (National Telecommunications and Information Administration) to radiate because of valid concern of radio frequency interference to existing users of these frequencies. Furthermore, because of its large weight, volume, and hardware and software complexity, extension of such systems to space-borne missions would be prohibitively massive and expensive.

Developing bi-static reflectometry creates the potential of directly observing SM and RZSM on a truly global basis from a constellation of small satellite-based receivers in low earth orbit.

The proposed antenna technology has potential to be used for Military Communication using combination of Follow-On satellites (GEO) and LEO satellites using the proposed antennas



Circularly Polarized Antennas Mounted on a 6U Cubesat Platform

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Links	3
Project Website:	3
Technology Areas	3

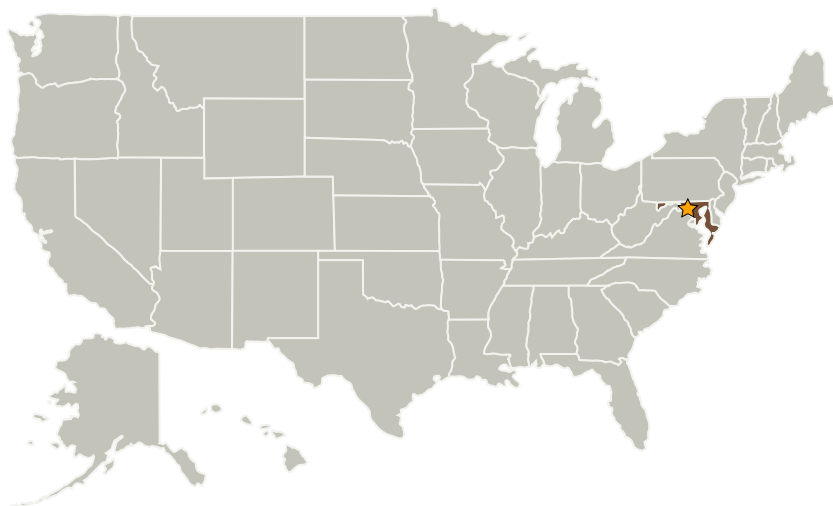
Design and Development of VHF Antennas for SoOp(Signal of Opportunity) Receiver for 6U Cubesat Platforms

Completed Technology Project (2014 - 2016)



1. DoD for target identification under heavy vegetation
2. US Dept of Agriculture for understanding surface and subsurface hydrology and soil conditions

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

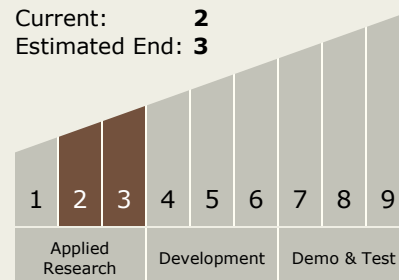
Terence A Doiron

Principal Investigator:

Manohar D Deshpande

Technology Maturity (TRL)

Start: 2
Current: 2
Estimated End: 3

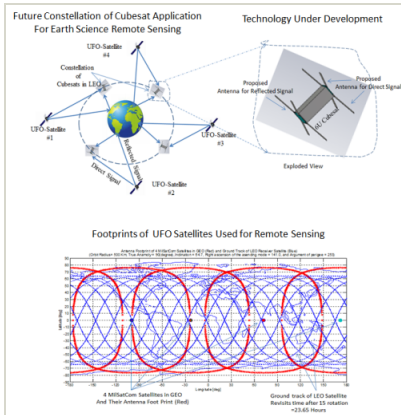


Design and Development of VHF Antennas for SoOp(Signal of Opportunity) Receiver for 6U Cubesat Platforms

Completed Technology Project (2014 - 2016)



Images



Design and Development of VHF (240-270 MHz) Antennas for SoOp(Signal of Opportunity) Receiver for 6U Cubesat Platforms

Circularly Polarized Antennas Mounted on a 6U Cubesat Platform
(<https://techport.nasa.gov/image/4176>)

Links

NTR 143102724
(no url provided)

Project Website:

<http://sciences.gsfc.nasa.gov/sed/>

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves